A cont

functional equivalent inductive element, or gyrator, has been devised. As shown in Fig. 3B, the gyrator comprises variable transconductance elements, GM, serially connected with a shunt capacitance, C.--

Rewrite the paragraph on page 2, lines 15-19.

A2

--A problem with the use of the known transconductance cell lies in adverse effects of source-bulk voltage (VSB) on MOS transistors used in the transconductance cell. Variations in VSB due to bulk (chip) stray voltages can adversely affect transconductance. Further, control voltage in a gyrator can have a limited dynamic range when using conventional enhancement MOS transistors.--

Rewrite the paragraph on page 2, lines 26-29.

A3

--A feature of the invention is the use of native transistors in the transconductance cell. The native MOS transistor has a lower threshold voltage V_t than the conventional enhancement MOS transistor, which leads to lower variation of GM due to source to bulk voltage variations.--

Page 3, after line 19, insert the following new paragraph:

A4

--Fig. 9 is a schematic of native transistors as used in a transconductance cell in accordance with the invention.--

Rewrite the paragraph at page 3, line 29 through page 4, line 5:

A5

-- Fig. 6 is a schematic of Vco 42 implemented as a second order harmonic oscillator including cross coupled transconductance cells 52, 54, and capacitors 53, 55 and a non-linear resistor 56. As noted above, the control voltage generated by ring oscillator of Fig. 5 is used to control the transconductance, GM, stages within the filter and hence the cutoff frequency of filters 24, 25. Each transconductance cell or GM stage can be identical schematically to the transconductance cell shown in Fig. 4 including

A5 cont'd

transistors 3 and 4 having gates 5 and 6, respectively, within circle 60. The circled transistor devices shown at 60 in Fig. 4 function as load resistors for current sources 62, 64 which are serially connected with current sources 63, 65 to provide two outputs Out P and Out N of the transconductance device. Block 66 is a voltage common mode feedback for the current sources, the details of which are known and not described further herein.--

Page 4, line 20-24, rewrite **Equation 2** as follows:

A6

--$Vt=Vt0+\gamma((\sqrt{2|\varphi F|+VSB})- +(\sqrt{2|\varphi F|}))$ **Equation 2**

Where Vt0=Vt(VSB=0),

γ Is the bulk threshold parameter ($\sqrt{\text{volts}}$)

φF is the strong inversion surface potential (volts)

VSB is the source to Bulk Voltage.--

Rewrite the paragraph at page 4, line 30 through page 5, line 12:

A7

--As noted from Equation 1, the threshold voltage, V_t, of the MOS transistors affects the transconductance. In accordance with the invention the use of a low to zero threshold voltage transistor, a "native" device, improves the filter performance in the presence of substrate noise. The native transistors 3',4' shown schematically in Fig. 9 are used in the transconductance cell of Fig. 4 in place of conventional enhancement mode transistors 3,4. As is well known in the semiconductor art, a "native" transistor does not have threshold adjusting dopants in the channel region as in conventional MOS transistors. The V_t of a native device used with the transconductance cell of Fig. 4 is a 0.041 volt has a saturation current, I_{sat} of 5.83 mA. Although the V_t of the native device has a similar dependence on VSB as does the conventional MOS transistor, its low absolute value with respect to a Vgs of approximately 500 mV, means that the overall transconductance does not vary much with VSB. Figs. 7A, 7B illustrate transconductance variance with varying VSB with a native